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FIRE PROBLEMS *Affecting*

BASIC PROTECTION OF CALIFORNIA NATIONAL FORESTS

1956

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FOREST SERVICE — SAN FRANCISCO 11, CALIFORNIA

August 30, 1956

TO : REGIONAL FORESTERS

FROM : REGIONAL FORESTER, R-5, By

SUBJECT: F-COOPERATION- State Legislature

In July 1956 the California Senate Committee on Public Lands held a hearing, part of which was to deal with the protection of California wildlands from fire. Mr. M. M. Nelson, Chief of our Division of Fire Control, made a presentation at the hearing using a set of charts. He entitled his presentation "Fire Problems Affecting Basic Protection of California National Forests."

The material presented by Mr. Nelson has been put into a lettersize booklet called "FIRE PROBLEMS." We thought you might be interested in the method of presentation and in the material that was presented in an effort to acquaint this group with a complicated problem in a simple manner.

Three copies of "FIRE PROBLEMS" are attached for your information.

Donald P. Bell

Attachments

cc: All Experiment Stations (with 1 attachment)

INTRODUCTION

Newspapers of the nation carried headline stories on Labor Day 1955 of one of the worst fire situations California had experienced since 1924. In 18 days flames swept more than 300,000 acres; 436 forest fires required 529 bulldozers and 18,400 men to suppress them. A billion and quarter feet of timber were burned.

Newspapers headlined a fire on the Angeles National Forest New Year's Day 1954. At this time a fire driven by high winds burned in one of the Nation's most valuable watersheds. It threatened several towns at the base of the mountains and Mt. Wilson, the television transmitting heart of Southern California. It burned 33 canyon homes. The fire was stopped short of Mt. Wilson and the three towns were saved from fire but soon were damaged by free flowing mud from the denuded mountain.

In July 1953 the news wires of the Nation carried the notice of 15 fire fighters who lost their lives fighting a forest fire on the Mendocino National Forest.

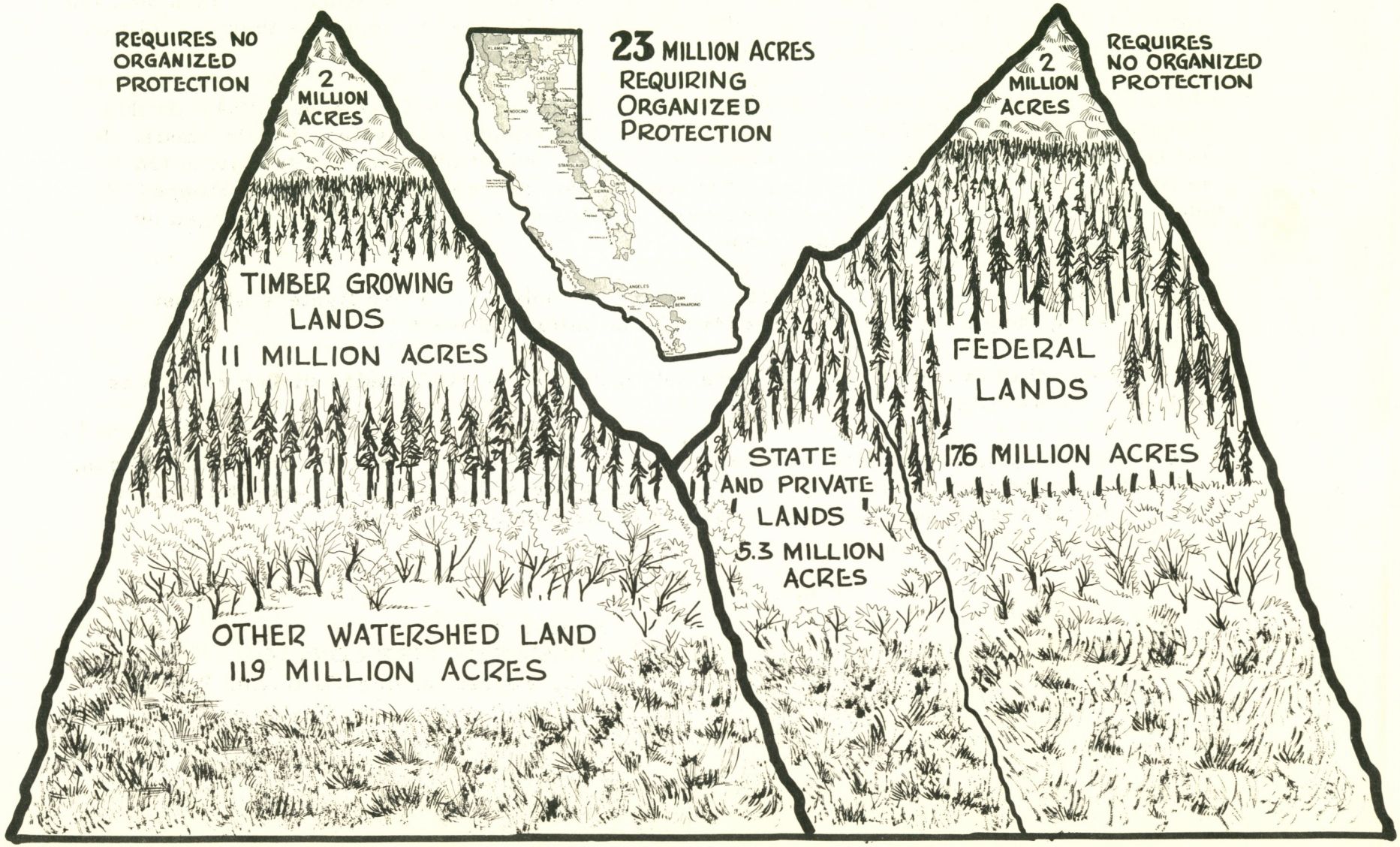
Forest fires of California have been extremely damaging to watersheds, timber resources and, yes, human life.

The California Legislature Interim Committee on Public Lands, headed by Senator Ed Regan, held a hearing in Sacramento July 13, 1956 in which forest fire problems were discussed. This material was prepared for and presented to the Interim Committee.

Prepared by
DIVISION OF FIRE CONTROL
U.S. Forest Service-California Region

THE NATIONAL FOREST PROTECTION JOB

INSIDE PROTECTION BOUNDARY - 1955



FIRE PROBLEMS - CHART NO. 2

THE NATIONAL FOREST PROTECTION JOB - 23 MILLION ACRES

The U. S. Forest Service has 23 million acres requiring organized protection within the protection boundary of the California Region. This land is scattered in the mountainous regions of the State from the Cleveland National Forest on the Mexican border to the Six Rivers National Forest in the redwood-producing northwest corner of the State. The Six Rivers Forest may have more rainfall on a single winter day than parts of the Cleveland receive in an entire year. In elevation the area protected varies from sea level to the highest point in the U.S.A.

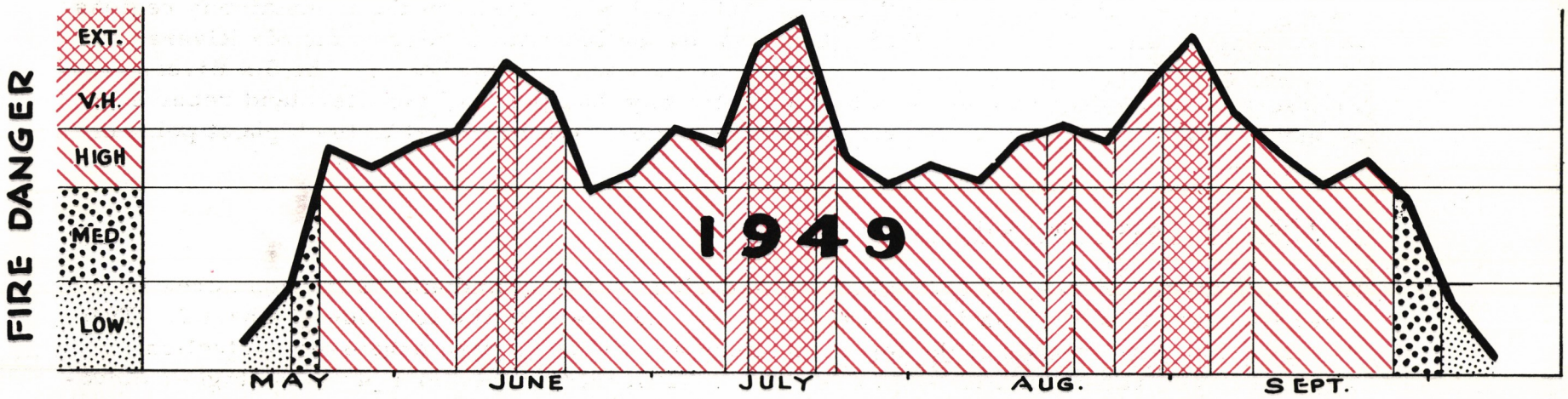
Half Timber Land - Half Other Watershed Land

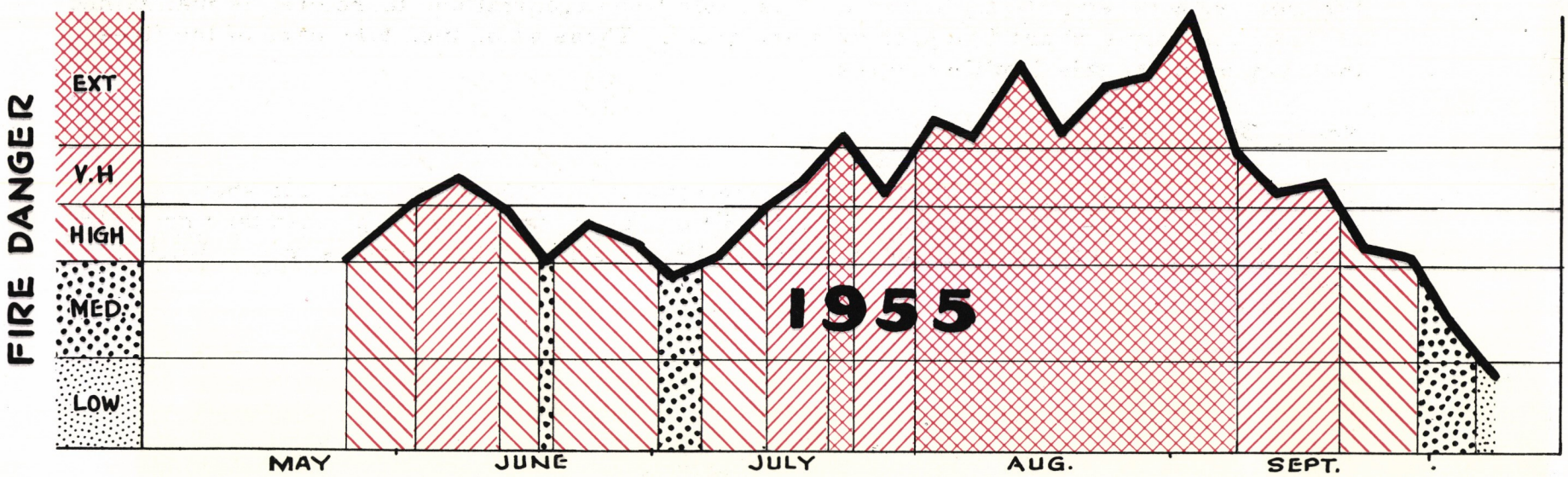
Of this 23 million acres, 11 million acres is timber-growing land and 12 million acres is other watershed land. This is represented as the mountain on the left side of Chart 2. Two million acres represented at the top of the mountain do not require organized protection. This area does require action when fires start, but it is, for the most part, the higher elevation country with fewer fire problems. The basic fire organization, therefore, is maintained at lower elevations where fire problems are great. These same men take care of the fires that may occur on this 2 million acres.

Nearly One-Fourth Private Land

The mountain on the right of Chart 2 shows the same 23 million acres, but this shows it divided between federally-owned land: 17.6 million acres, and State or private land protected by the U. S. Forest Service under agreement with the State. This amounts to 5.3 million acres.

CALIFORNIA
WEATHER FAVORS FIRE
PREDICTIONS ARE DIFFICULT
SEASONAL FIRE DANGER - KLAMATH NAT'L. FOREST
HILT RATING STATION





FIRE PROBLEMS - CHART NO. 3

Problem Number Two

CALIFORNIA WEATHER FAVORS FIRE

The fine California weather that causes tourists to spend their vacation in the State is also the type of weather that favors forest fires. California's Mediterranean climate means a longer burning season than other parts of the United States. Southern California has experienced major fires in every month of the year. The Forest Service was fighting fire on January 1, 1954 and still other fires after Christmas Day of 1954.

The Forest Service uses a scientifically designed system of measuring "Fire Danger". Each day of the fire season is given one of five ratings from low to extreme. This is called "FDR" for fire danger rating.

Bad Fire Weather Varies Within Season

Chart 3 shows the F. D. R. for a station on the Klamath National Forest for 1949 and 1955. Both of these years were bad fire years. Note that 1949 is marked by three distinct periods of extreme weather. This pattern gave the organization some "Breathing periods" during the season. 1955 in contrast was marked by one long extended period of bad fire weather. From mid-July to mid-September, the area was in very high or extreme fire danger.

Bad Fire Weather Varies Between Years

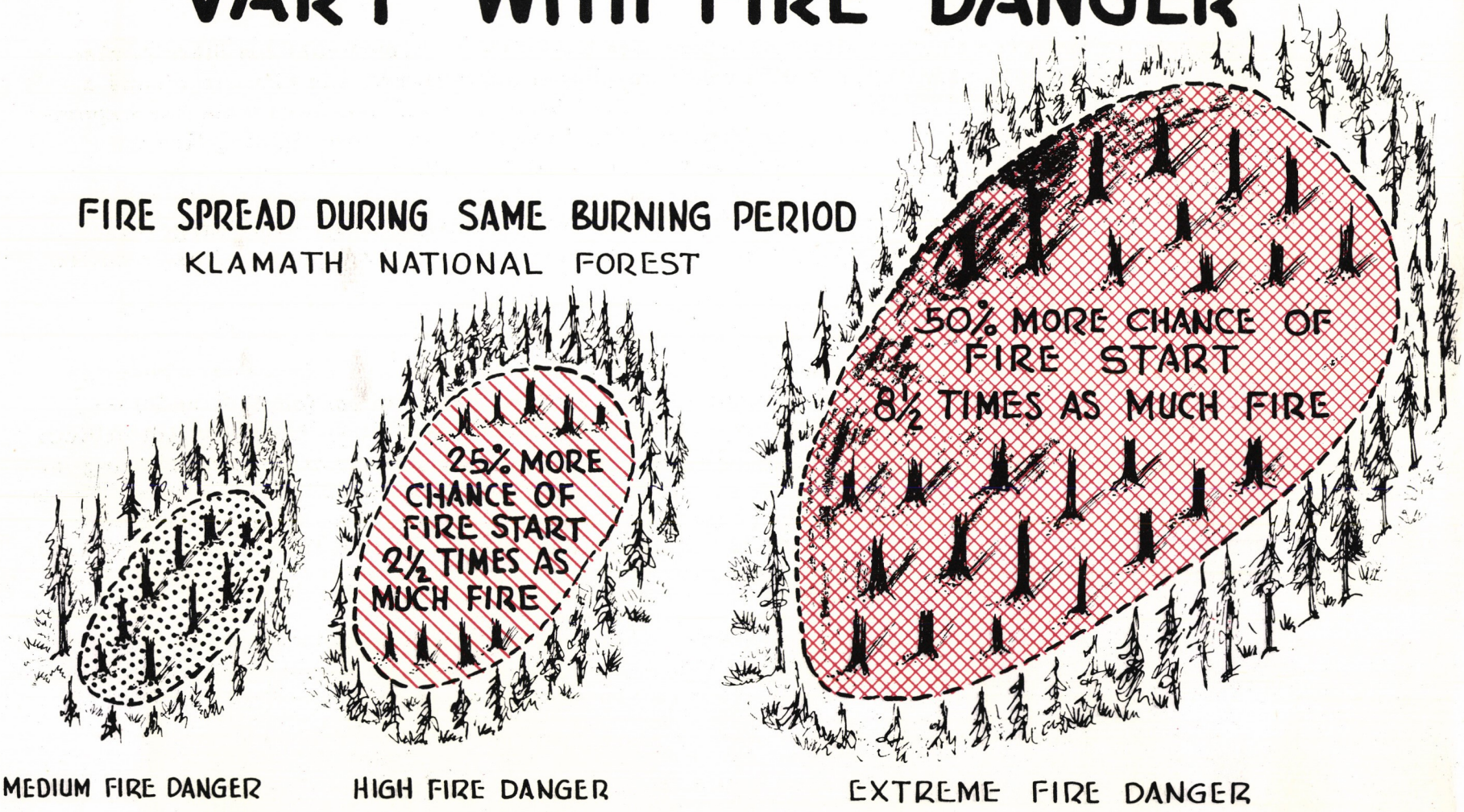
Chart 3 shows varying conditions during two bad years. The Forest Service uses severity rating system for comparison between years. This cumulative fire-weather severity index shows, on the Klamath, that 1949 was twice as bad as the average fire weather and 1955 was three times worse than the average.

CALIFORNIA WEATHER FAVORS FIRE

FIRE STARTS AND FIRE SPREAD VARY WITH FIRE DANGER

FIRE SPREAD DURING SAME BURNING PERIOD

KLAMATH NATIONAL FOREST


25% MORE CHANCE OF FIRE START 2½ TIMES AS MUCH FIRE
50% MORE CHANCE OF FIRE START 8½ TIMES AS MUCH FIRE
MEDIUM FIRE DANGER
HIGH FIRE DANGER
EXTREME FIRE DANGER

CALIFORNIA WEATHER FAVORS FIRE

Fire danger has a tremendous effect on forest fire business. Chart 4 shows what happens when fires start on days with three different fire-danger ratings.

The Higher the F.D.R. the Larger the Fire

An average fire starting when F.D.R. is extreme would be 8-1/2 times larger than the same fire starting under medium F.D.R. If it started on a day of high F.D.R. it would be 2-1/2 times larger than under medium F.D.R.

The Higher the F.D.R. the More Fires

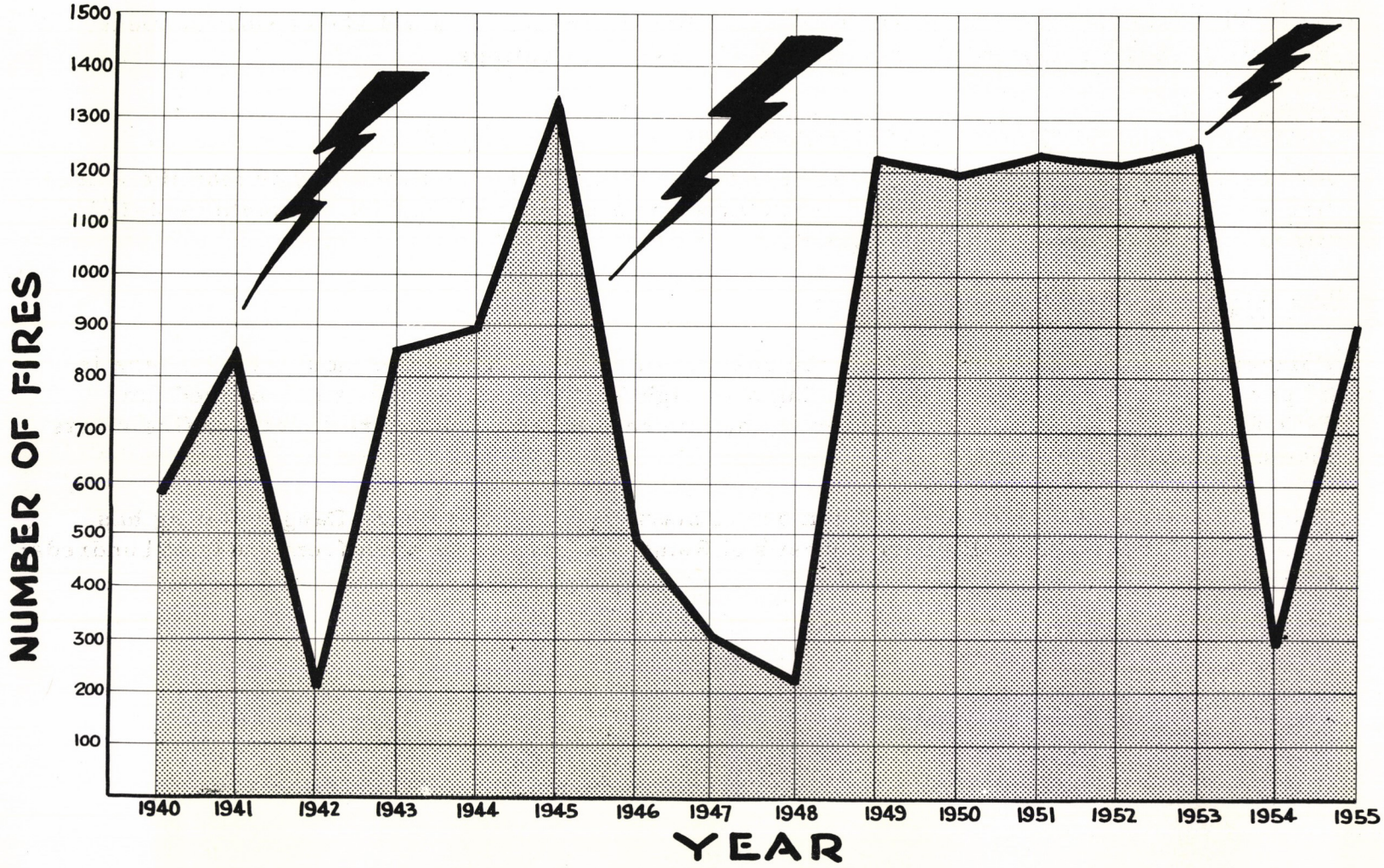
Furthermore under bad fire weather the chances of a fire starting are increased. There is 25 per cent more chance of fires starting on a high F.D.R. day than on a day of medium F.D.R. When F.D.R. increases to extreme, there is 50 per cent more chance of fire starts than on a day of medium F.D.R.

The relationship of size of fire and number of starts in relation to Fire Danger Rating has been worked out by the California Forest and Range Experiment Station from study of hundreds of fires.

CALIFORNIA WEATHER FAVORS FIRE

PREDICTIONS ARE DIFFICULT

LIGHTNING FIRE OCCURRENCE INSIDE NATIONAL FOREST PROTECTION BOUNDARY



FIRE PROBLEMS-CHART NO.5

CALIFORNIA WEATHER FAVORS FIRE

Lightning a Serious Problem

Lightning is another factor of weather that favors fire in California. Chart 5 indicates the number of lightning fires occurring within the National Forest protection boundary since 1940. Note that the number varies from only about 200 in 1942 up to more than 1,300 fires in 1945. The 5 year period of 1949 to 1953 was consistently bad with about 1,200 fires each year.

Wet vs. Dry Lightning

Most lightning storms are accompanied by some moisture which makes suppression of fires easier. Some storms, however, are "dry storms". When this occurs, the fires are much more difficult to control. Some years there is a deficiency of precipitation during the winter and spring season. Then if a dry lightning storm sets many fires, the protection organization is sure to have trouble. That is the situation which existed on Labor Day 1955 on the Klamath National Forest.

ROUGH TOPOGRAPHY FAVORS FIRE

ROUGH TOPOGRAPHY FAVORS FIRE

Much of the area of California protected from fire by the Forest Service is made up of rough topography. In this type of terrain, fires are difficult to find, difficult to reach, and difficult to fight. This is illustrated by Chart 6, which is an actual picture of the Fish Fork Fire. This fire, started by lightning in a roadless part of the Angeles National Forest, burned in very rugged country.

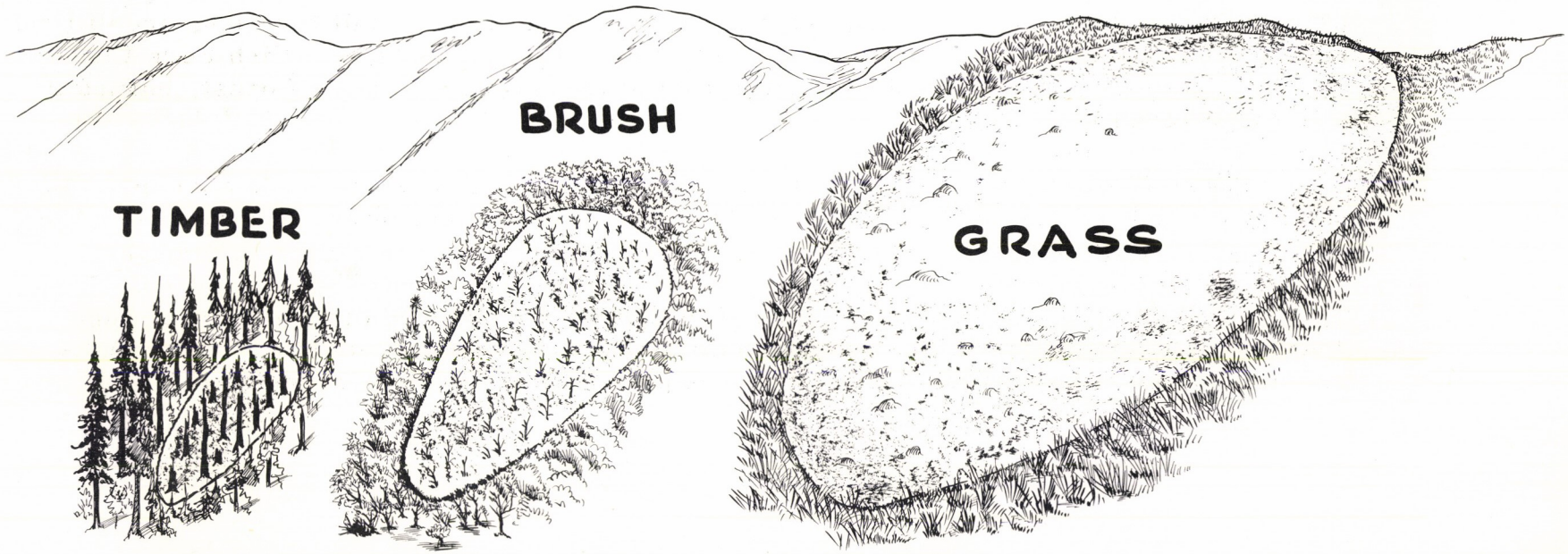
Had a person hiked all the way around the fire, he would cover a vertical distance equal to starting at sea level and climbing over the top of Mt. Whitney and down, then repeating the same climb two more times.

The lower right corner of the chart shows 10 Washington Monuments piled on top of each other. This equals in elevation (more than a mile) the climb the firefighters had to make from the bottom of one canyon to the top of one peak (not the highest) on the fire line.

WILDLAND COVER FAVORS FIRE

RATE OF SPREAD

BURNING RATES VARY WITH FOREST COVER



Area burned in different cover types during same time interval

AGRICULTURE—FOREST SERVICE—SAN FRANCISCO

Problem Number Four

WILDLAND COVER FAVORS FIRE

The type of plant cover affects a fire in two ways: the "rate of spread" and the "resistance to control".

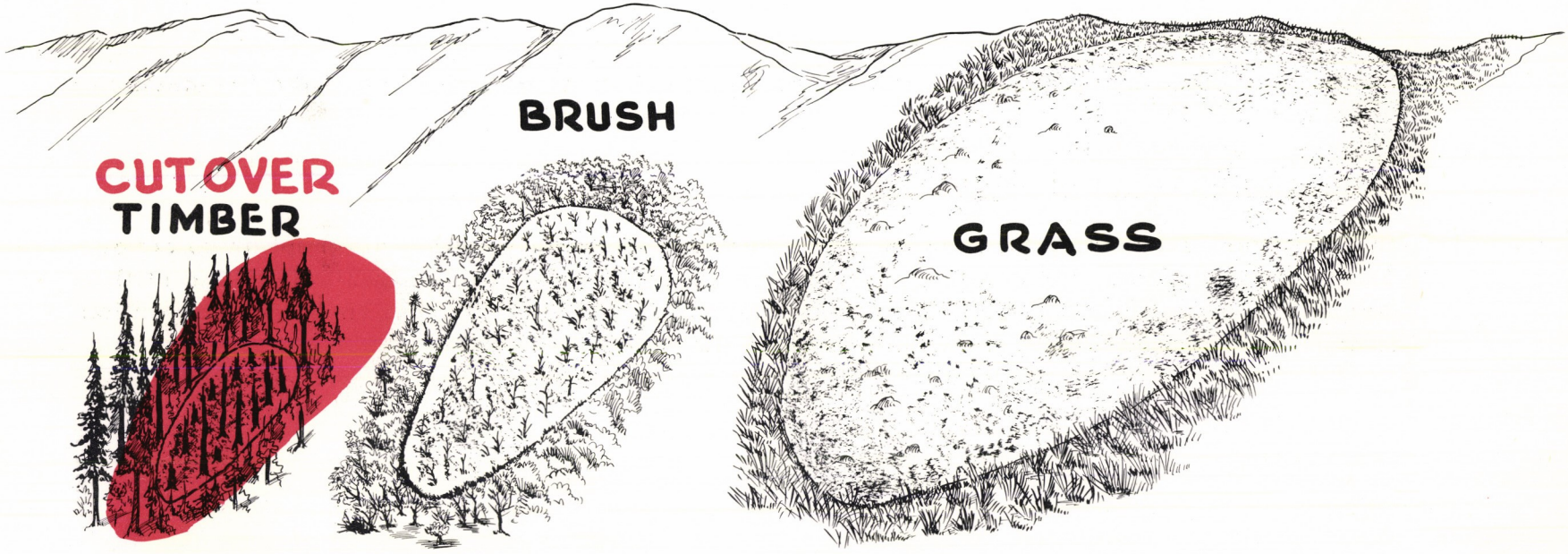
Burning Rates Vary With Cover Type

Chart 7 illustrates a fire burning under conditions equal in all respects except as to cover. The fire would be smallest in the uncut timber stand, larger in the brush stand, and still larger in the grass area. The size of each burned area on the chart is in direct proportion to expected average situation on the ground in the three cover types.

WILDLAND COVER FAVORS FIRE

RATE OF SPREAD

BURNING RATES VARY WITH FOREST COVER



Area burned in different cover types during same time interval

AGRICULTURE–FOREST SERVICE–SAN FRANCISCO

WILDLAND COVER FAVORS FIRE

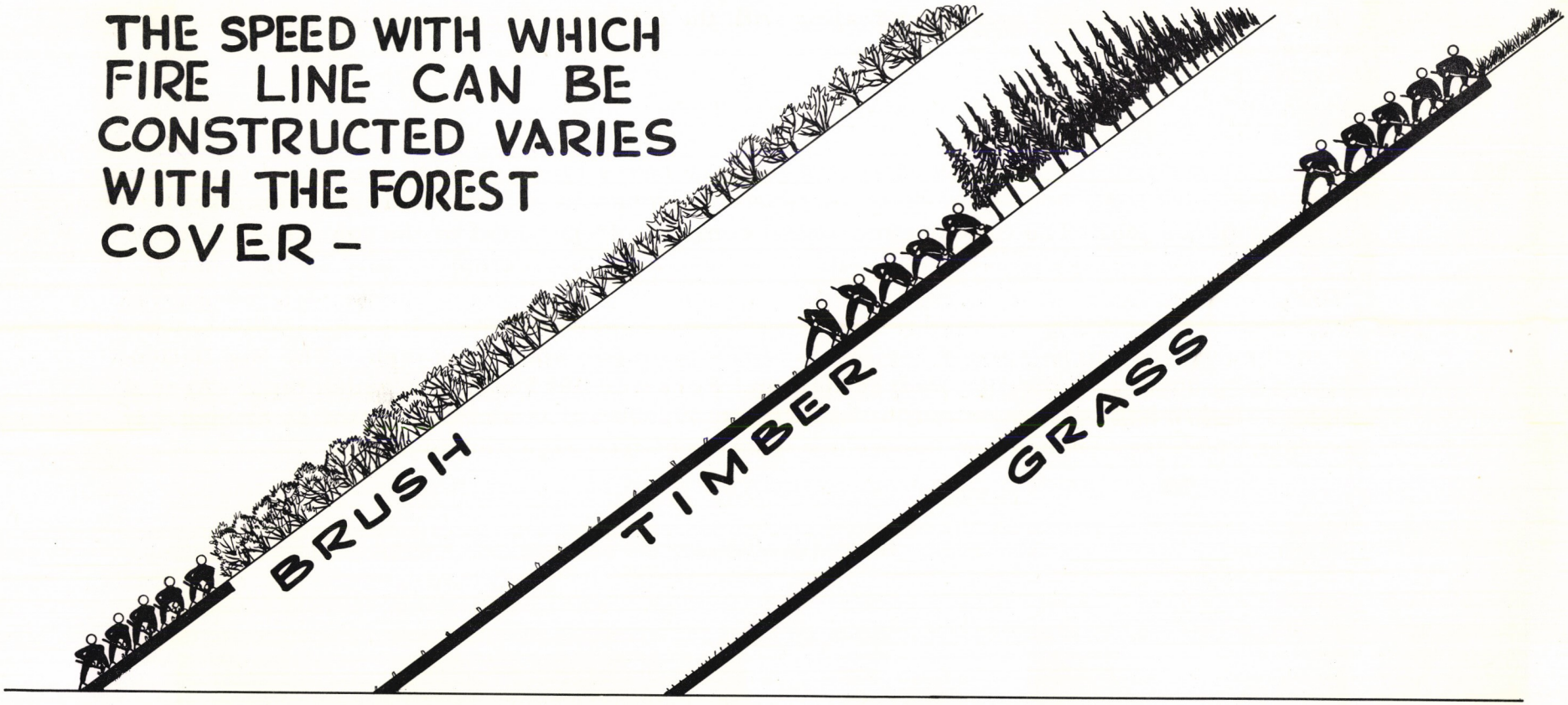
Logging Increases Rates of Spread

When the forest is logged, rate of spread goes up. If 70 per cent of the trees are removed, the cover is changed so that the fire would be three times larger than it would have been before logging. Some of this increase is caused by more fuel on the ground, but part is the result of the timber stand being opened up to drying and heating by the sun and the effect of wind upon the fuel or the fires.

WILDLAND COVER FAVORS FIRE

RESISTANCE TO CONTROL

THE SPEED WITH WHICH FIRE LINE CAN BE CONSTRUCTED VARIES WITH THE FOREST COVER -



5 MEN BUILDING FIRE LINE FOR 1 HOUR

AGRICULTURE-FOREST SERVICE-SAN FRANCISCO

WILDLAND COVER FAVORS FIRE

"Resistance to Control" is a term dealing with the difficulty of constructing a fire line around a fire.

Speed of Line Construction Varies with Cover Type

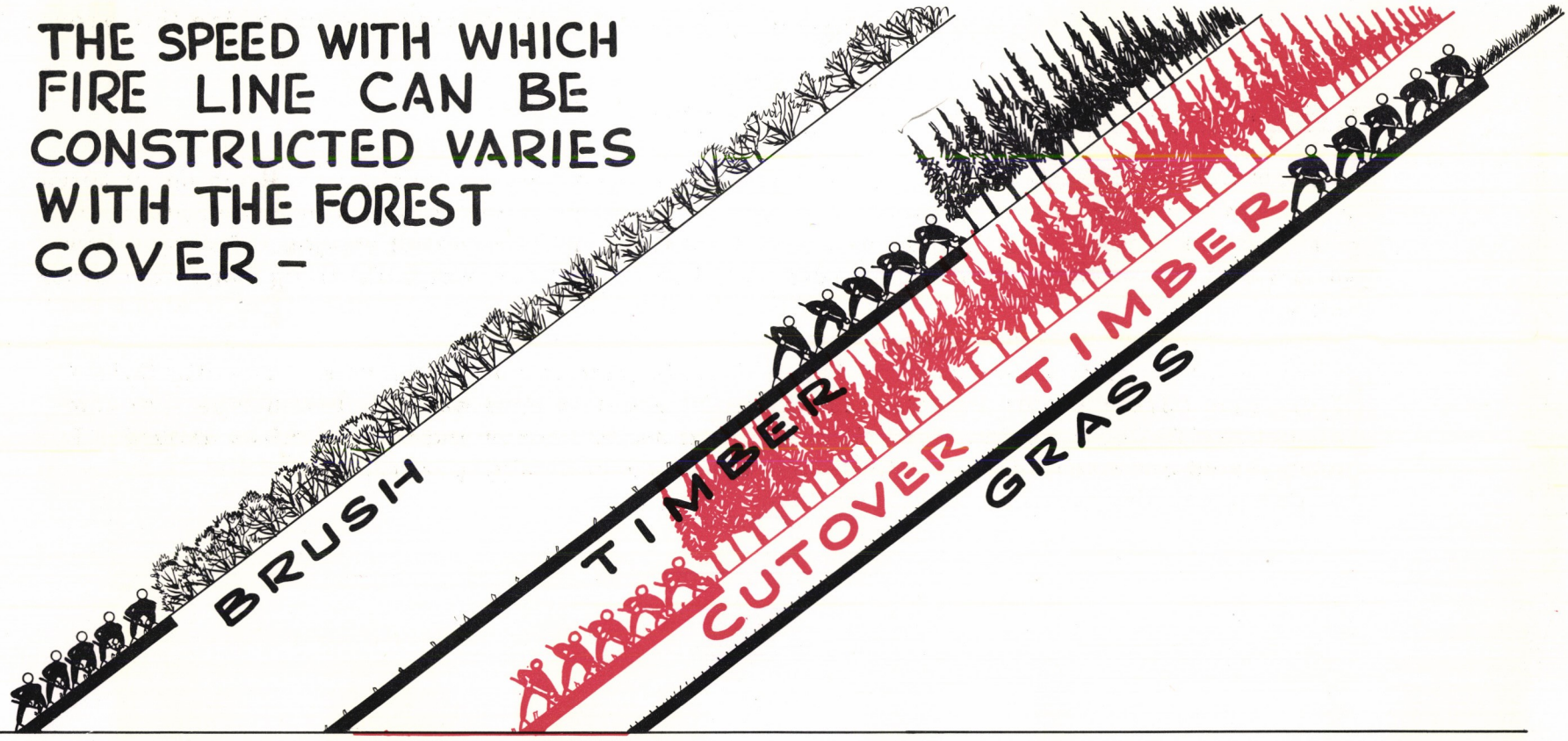
Chart 8 shows fire line being constructed in three cover types: brush, grass and uncut timber. Five men work for 1 hour in each cover type. The crew in grass would have completed 90 per cent of the job. The timber crew would complete 75 per cent of the job. But the crew working in the average brush type would have been able to accomplish only 15 per cent of its work.

In the brush type, fires spread rapidly, and resistance to control is high. The Big Dalton Fire which burned on the Los Padres National Forest in 1953 was in a brush type. At midnight, 10-1/2 hours after origin, it had burned 39,000 acres and was 41 miles around. It averaged 60 acres burned per minute and 4 miles of fire edge per hour.

WILDLAND COVER FAVORS FIRE

RESISTANCE TO CONTROL

THE SPEED WITH WHICH FIRE LINE CAN BE CONSTRUCTED VARIES WITH THE FOREST COVER -



5 MEN BUILDING FIRE LINE FOR 1 HOUR

AGRICULTURE-FOREST SERVICE-SAN

WILDLAND COVER FAVORS FIRE

Logging Increases Resistance to Control

Logging a stand of timber changes, not only the rate a fire will spread, but also its resistance to control.

Chart 8A is the same as Chart 8 except it shows, in red, that after logging the difficulty in line construction has increased so much that the 5 man crew can build lines only one-fourth as fast as they could before the timber was logged. The cut-over timber type is about the same as the average brush cover.

More than one-fourth million acres of forested land has been logged on the protection area of just one National Forest (the Shasta-Trinity) in the past 10 years. Fires on this land now burn faster and are harder to suppress. Logging on federal lands accounted for 22 per cent of this area, the rest was on private land.

INCREASING USE FAVORS FIRE STARTS

CALIFORNIA NATIONAL FORESTS

1945

1955

TIMBER HARVESTING

440 MILLION FEET

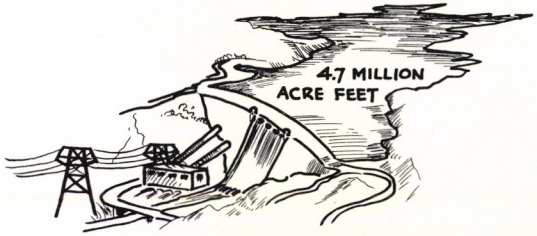
1 BILLION FEET

RECREATION USE

3.3 MILLION VISITORS

8 MILLION VISITORS

WATER DEVELOPMENT



11.8 BILLION KILOWATT HRS.

13.6 BILLION KILOWATT HRS.

INCREASED USE FAVORS FIRE STARTS

The chance of a man-caused fire starting on wild land is in relation to the use made of the land. In general, the greater the use the greater the risk. Chart 9 illustrates, as examples, three types of uses in 1949 and 1955.

Timber Harvesting Increased 127 Per Cent

In 1944 only 440 million feet of timber was cut from national forest lands of California. By 1955 this cut had increased to a billion feet of timber. In addition, cutting of private timber on lands protected by the Forest Service also increased greatly.

Recreation Use Increased 142 Per Cent

Three and a third million recreationists used the national forests of California in 1945. This does not include people just traveling through the forests. By 1955 the number of recreation users had jumped to 8 millions. The facilities for taking care of these 8 million people are approximately the same as they were prior to World War II. This means many recreationists are forced to camp and to use areas of higher hazard than is desirable.

Water Developments on Increase

Practically all major cities of California receive a high percentage of their domestic water supply from the national forests. Water storage capacity on national-forest lands increased from 4.7 million acre feet in 1945 to 13.3 million acre feet in 1955. During the same period electric production increased about 15 per cent to 13.6 billion kilowatt hours. This is enough power to supply the 114,000 customers of the Sacramento Municipal Utility District for 17 years.

INCREASING USE FAVORS FIRE STARTS

RISKS

FIRES ARE STARTED IN MANY WAYS

CAMPFIRES

CRASHED PLANES

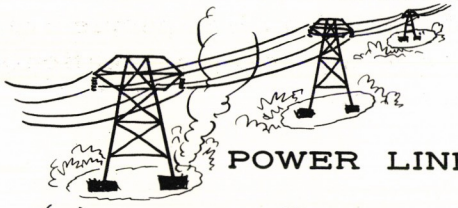
CHILDREN WITH MATCHES

SMOKING

LIGHTNING

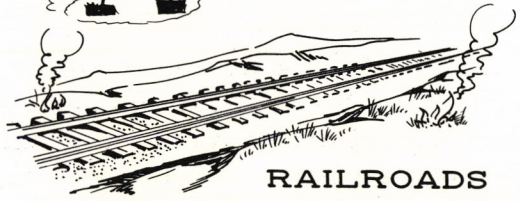
BURNING BUILDINGS

INCINERATORS



POWER LINES

BURNING TRASH



RAILROADS

BURNING VEHICLES

INCENDIARISTS

AND IN MANY OTHER WAYS

INCREASED USE FAVORS FIRE STARTS

There are Many Risks

Chart 10 illustrates some of the many ways fires are started within the national forest protection area.

Five-Year Average Number of Fire Starts

General Cause	Number	Some Specific Causes of Fires Classed as Miscellaneous:	Number
Smokers	281	Children with Matches	38
Campers	88	Burning Buildings	42
Debris Burning	44	Burning Vehicles	17
Lumbering	48	Crashed Aircraft	3
Incendiary	38	Power Lines	12
Railroads	27		
Miscellaneous	183		
Total Man-Caused	709		
Lightning	973		
Grand Total	1682		

INCREASING VALUES JUSTIFY INCREASING PROTECTION

VALUES

VALUES PROTECTED VARY BY AREAS

HIGH VALUES

LOW VALUES

AGRICULTURE—FOREST SERVICE—SAN FRANCISCO

TIMBER

Problem Number Six

INCREASING VALUES JUSTIFY INCREASING PROTECTION

As the value of any property increases, it is justifiable to give it better protection. In one sense, this is what a person does when he purchases additional insurance at the time his home increases in value. The insurance against losses to a forest property by fire is the strength and efficiency of the organization protecting it from fire.

Timber Values Have Increased

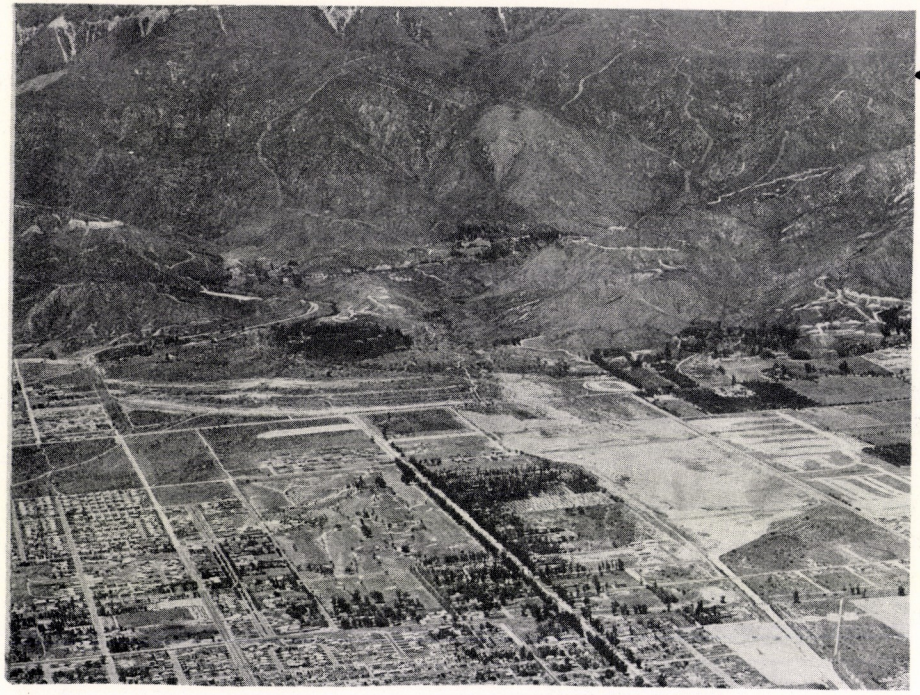
Timber growing on the national forest in 1955 was worth 5 times more than it was 10 years ago. In 1955 bidders paid an average of $15.45 for a thousand board feet of national forest timber. In 1945 they paid only $3.07.

Chart 11 shows a high value timber stand and a low value area. Plans for protection from fire must be made to vary the degree of protection with the value protected.

INCREASING VALUES JUSTIFY INCREASING PROTECTION

VALUES

VALUES PROTECTED VARY BY AREAS



HIGH VALUES

LOW VALUES

WATERSHEDS

INCREASING VALUES JUSTIFY INCREASING PROTECTION

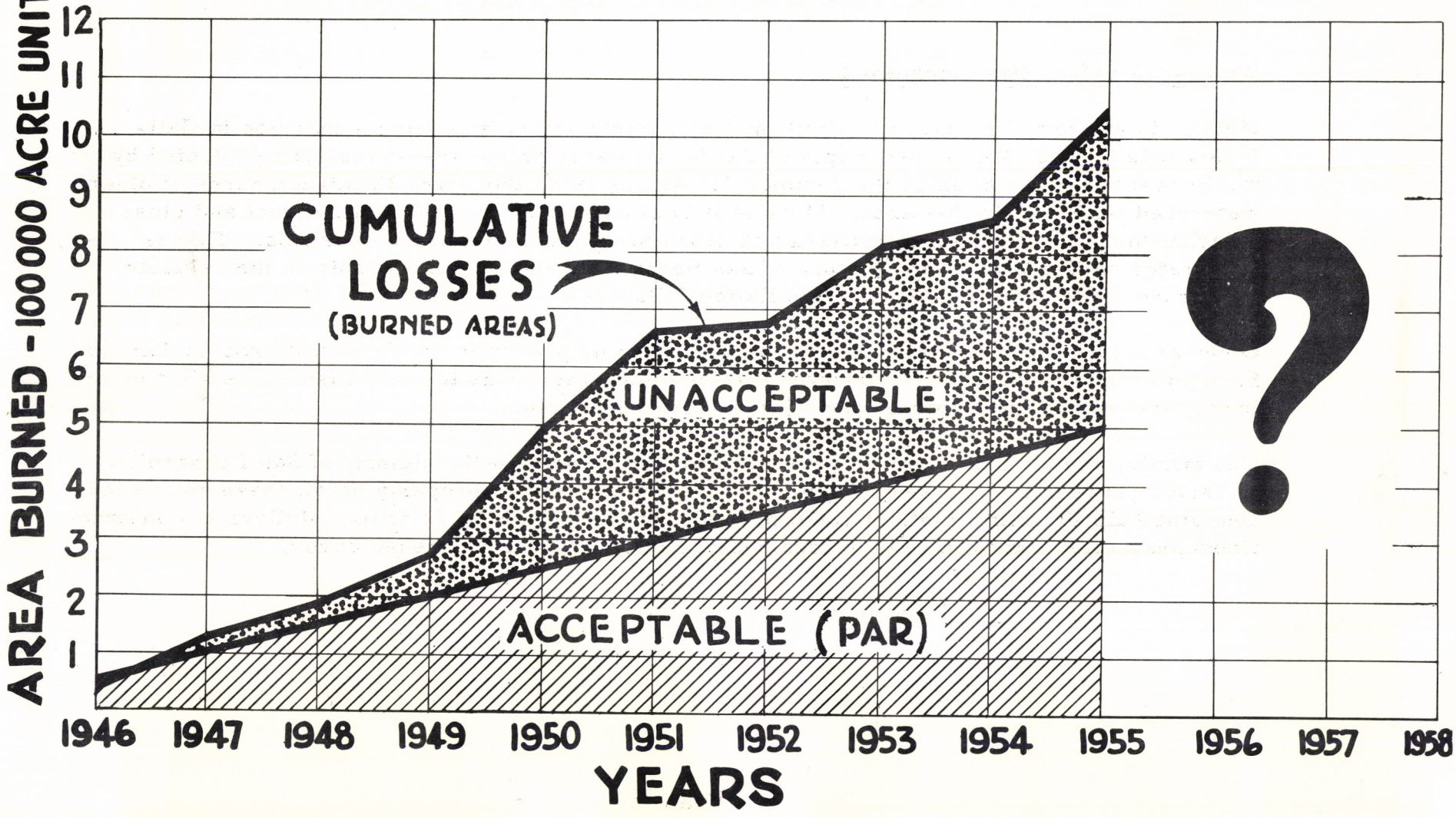
Watershed Values Have Increased

If there is any one thing that will limit industry, agriculture, and urban expansion in California it is water. The major supply of California water originates on the area protected by the Forest Service. Besides the commercial timber land, there are 12 million acres of other watershed lands within this area. Much of it is of extreme value due to its direct and close relationship with highly industrialized and urbanized lands below the watersheds. This is illustrated on Chart 12 by the picture of San Bernardino and its relationship to the valuable watershed lands of the San Bernardino National Forest.

Other areas are of lower value for water production or prevention of flood and erosion damage. Such an area is pictured by the relationship of some watersheds to desert lands. As in timber lands, the more valuable watersheds justify better protection.

The burning of the plant cover on several small watersheds in the vicinity of San Bernardino in recent years has increased the potential damage by flood to property below these watersheds. One small flood-control district voted to bond themselves for 2-1/2 million dollars to construct flood-prevention improvements needed because of the loss of watershed cover.

NATIONAL FOREST PROTECTION
ADEQUATE OR INADEQUATE ?



PROTECTION-ADEQUATE OR INADEQUATE?

Some of the problems affecting basic protection have been reviewed on the preceding pages. To complete the picture, it is desirable to look at the record of the past 10 years to determine if an adequate job of protection from fire has been accomplished.

Fire Losses Double What They Should Be

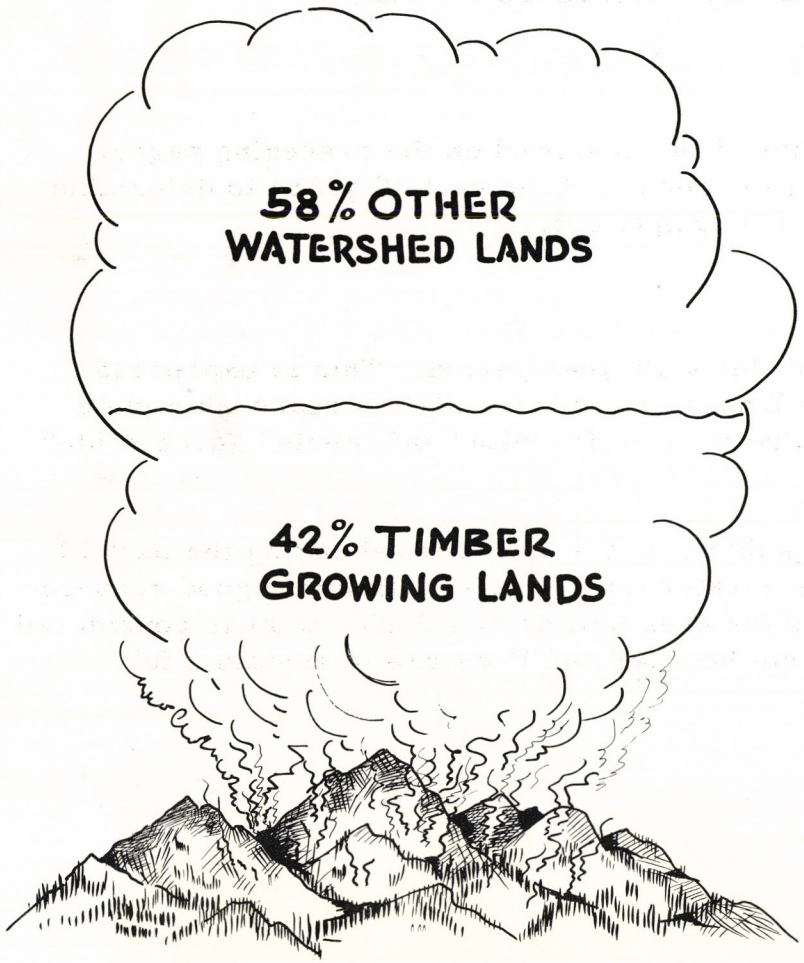
Total cumulative loss by fire is shown on Chart 13 for a 10-year period. This is expressed in area burned. It is possible to stand some fire losses and still maintain a reasonable yield of products and uses from the forest. This is "what we can live with" and labeled "acceptable" on the chart. It is sometimes called "par".

The dark upper part of the chart, labled "unacceptable", is the area burned during the past 10 years which is above "par". It is an area of loss greater than can be continued if good resource management is practiced. By the end of 10 years the area burned was double what is considered as an acceptable loss. This staggering loss can not be tolerated if we are to sustain a full yield from forest resources.

IS THIS ADEQUATE PROTECTION?

THE TEN YEAR RECORD

1946 - 1955 - INSIDE N.F. PROTECTION BOUNDARY



1 MILLION ACRES BURNED

1.1 BILLION BOARD FEET OF TIMBER BURNED

PROTECTION-ADEQUATE OR INADEQUATE?

Ten Years of Destruction

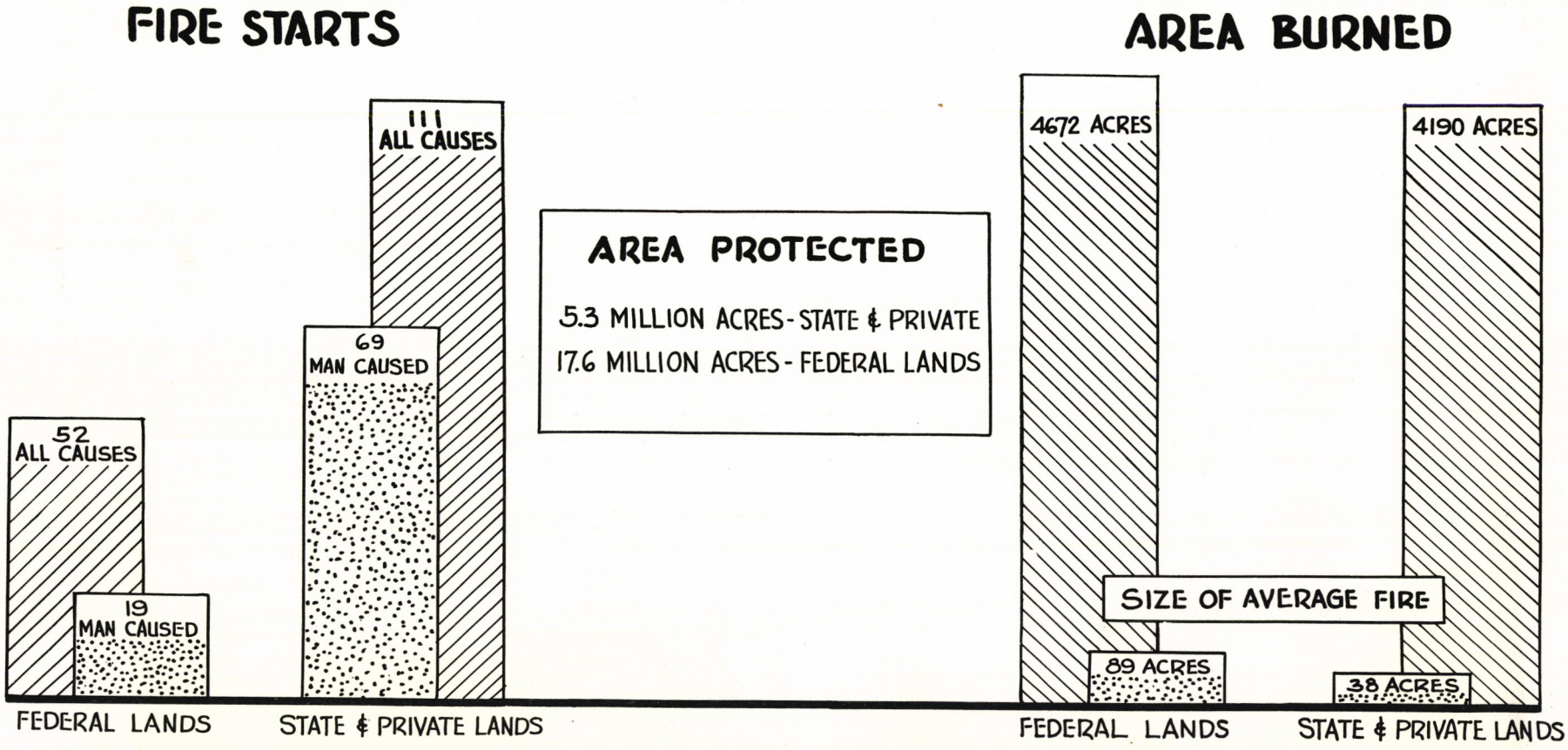
Chart 14 shows the cumulative 10-year loss in another manner. One million acres have been burned over since 1946. Of this 42 per cent was commercial timber-growing land, and 58 per cent was other watershed land.

More than a billion board feet of timber burned. This is more than the total cut of national-forest timber cut in California in 1955-- the year of maximum harvest. Some of the timber burned is salvaged but a high percentage is lost completely. And when young trees burn, the future burns -- timber harvests will be reduced in future years.

PROTECTION RESULTS

INSIDE NATIONAL FOREST PROTECTION BOUNDARY

10 YEAR AVERAGE 1946-1955



FIRE STARTS AND AREA BURNED - SHOWN ON BASIS OF AVERAGES PER MILLION ACRES PROTECTED

PROTECTION RESULTS

Chart 15 shows a comparison of the protection on national forest land and that on private land protected by the Forest Service. This comparison is reduced to a common denominator of million-acre units.

More Fires Start on Private Land

The bars at the left of Chart 15 show that twice as many fires have started on private land, per million acres protected, as on national-forest land. When comparing only man-caused fires, private lands have been the source of 3-1/2 times more fires than national-forest lands.

Private and Federal Land Protection Equal

The right side of the chart shows the area burned, per million acres, is approximately the same on the federal lands and the private land protected by the Forest Service, Region 5. This means that the average size of any single fire on the private land was 38 acres whereas on federal land it was 89 acres.

THE ANSWER

1. AN ADEQUATE FIRE PROTECTION ORGANIZATION SCIENTIFICALLY DESIGNED - PROPERLY FINANCED

2. REASONABLE LAND USE AND LAND MANAGEMENT PRACTICES

3. AN EXPANDED PROGRAM OF FIRE RESEARCH

SUMMARY

Problems:

A summary of some of the fire problems affecting basic protection of the California National Forests and intermingled private land follows:

A. Twenty-three million acres to protect under widely varying conditions.
B. A weather situation which favors fire and is both variable and unpredictable.
C. Exceedingly long fire seasons - year long in part of State.
D. Lightning severe, and sometimes "dry".
E. Rough topography.
F. Wild land cover, much of which is favorable to fire spread.
G. Wild land cover, much of which makes fire suppression difficult.
H. A change in cover, such as virgin timber to logged land, which increases difficulty in suppression and rate of spread.
I. Increasing use of forest lands, well over 100 per cent in 10-year period.
J. Increased values, both in timber and watershed which justify increased protection.

Results:

Some of the results of protection have been shown: a billion feet of timber burned, a million acres burned over. Losses have been almost double what should be considered acceptable. The record is not good. A better job of protection from fire is required.

THE ANSWER

Chart 16 shows the answer in three broad parts. The full story on each part is a complete subject in itself. The following will explain the parts a little more:

1. An adequate protection organization must include PREVENTION, DETECTION, and SUPPRESSION. Each part must be scientifically designed to include all phases of each part and each must be properly financed in a balanced fashion. For example, prevention must include hazard reduction, law enforcement and "man to man" fire prevention as well as the mass media "Smokey Bear" type of fire prevention.

2. Reasonable Land Use means considering what impact each use or management practice will have on the over-all basic protection problem, both for the present and future. The impact, if unfavorable, must then be balanced either by modification of the use or practice or by a revised protection practice.

3. Fire research today must meet the expanding nation-wide need of civil defense, urban, and forest firefighters for new knowledge, techniques, and equipment in fire prevention and firefighting. Some of the potentials of an accelerated research program are described in McCulloch Motor Bulletin 707 entitled, "Forest Fire Research Can Increase Your Measure of Success".